

PATENT APPLICATION



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE HONORABLE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the Application of

Yukuo KATAYAMA

Application No.: 10/564,988

Examiner: M. PO

Filed: January 18, 2006

Docket No.: 126599

For: METHOD FOR DEWATERING WATER-CONTAINING COAL

BRIEF ON APPEAL

Appeal from Group 1771

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Application No. 10/564,988

REAL PARTY IN INTEREST

The real parties in interest for this appeal and the present application are the inventor Yukue Katayama and K.E.M. Corporation, by way of an Assignment recorded in the U.S. Patent and Trademark Office at Reel 017534, Frame 0984.

II. RELATED APPEALS AND INTERFERENCES

The following are prior or pending appeals, interferences or judicial proceedings, known to Appellant, Appellant's representative, or the Assignee, that may be related to^o or that will directly affect or be directly affected by or have a bearing upon, the Board's decision in the pending appeal:

Pending Appeal of Related Application No. 11/662,969 in which a Notice of Appeal was filed on July 13, 2011 (Appeal Number Unavailable).

III. STATUS OF CLAIMS

Claims 1-17 are on appeal.

Claims 1-17 are pending.

No claims are allowed, and none of the claims are objected to only for being dependent from a rejected base claim, but are otherwise allowable.

Claims 1-17 are rejected.

None of the claims are withdrawn from consideration.

No claims are canceled.

IV. STATUS OF AMENDMENTS

No Amendment After Final Rejection has been filed.

V. SUMMARY OF CLAIMED SUBJECT MATTER

Independent claim 1 and dependent claims 2-17 are summarized below with reference to the specification. Any reference to the specification is only exemplary and should neither be construed to encompass every portion of the specification that supports the various claim features nor construed to limit the claimed subject matter beyond the claim language.

Water-containing coal (brown coal) has many water-filled pores in its structure (i.e., water is within pores that are inside the particle, as opposed to in the space between particles). *See* specification at page 1, lines 10-18. However, coal particles are strong, so even after pulverization and drying the size and number of pores remain substantially unchanged. *See id.* Consequently, after brown coal is dried, oxygen can intrude into the empty pores, causing oxidative damage and spontaneous firing. *See id.* This makes it unsuitable to transport or store brown coal that is dried by traditional means, thereby limiting use of this resource to areas near coalfields. *See id.*

The claimed method relates to a novel method of dewatering coal, wherein (unlike known methods) the pore structure of water-containing coal is substantially destroyed. *See* specification at page 1, lines 18-26; page 3, lines 16-22. By reducing pore volume to as much as one-third of the original pore volume, the dewatered coal is inhibited from reabsorbing both water and oxygen after dewatering. *See* specification at page 2, lines 18-20. As a result, coal dewatered by the present invention can be (1) transported as a water slurry (it won't re-absorb water) and (2) stored and transported in a dry form without spontaneously firing (no oxygen intrusion). *See* specification at page 1, lines 21-25.

In order to achieve such extensive pore destruction, the present disclosure teaches that pressure, heat, and a high shear force must be applied to the water-containing coal. *See* specification at page 3, lines 3-9. High shear force is critical, and cannot be obtained by

traditional de-watering methods that only include compaction and heating. *See* specification at page 1, lines 19-26.

A. Claim 1

Claim 1 is directed to a method for dewatering coal. The method comprises: (1) heating the coal in a sealed vessel (page 6, line 24 to page 7, line 5); (2) at a temperature of 100°C to 350°C (page 7, lines 6-16); (3) under a pressure not less than a saturated steam pressure at the heating temperature (page 7, line 17 to page 8, line 5); while (4) simultaneously applying a shearing force of 0.01 MPa to 20 MPa to the coal (page 8, line 6 to page 9, line 27).

B. Claim 2

Claim 2 depends from claim 1 and, therefore, contains all the limitations of claim 1. Claim 2 further provides for a stirring blade in a sealed vessel (page 8, lines 13 and 14).

C. Claim 3

Claim 3 depends from claim 1 and, therefore, contains all the limitations of claim 1. Claim 3 further provides for a heating temperature of 150°C to 300°C (page 7, lines 6-8).

D. Claim 4

Claim 4 depends from claim 1 and, therefore, contains all the limitations of claim 1. Claim 4 further provides that the pressure during heating is not more than the saturated steam pressure at the heating temperature + 0.5 MPa, provided that the pressure does not exceed 17.8 MPa (page 7, lines 24-30).

E. Claim 5

Claim 5 depends from claim 1 and, therefore, contains all the limitations of claim 1. Claim 5 further provides that the shearing force is 0.1 MPa to 10 MPa (page 8, lines 7-9).

F. Claim 6

Claim 6 depends from claim 1 and, therefore, contains all the limitations of claim 1.

Claim 6 further provides that the heating is conducted for a period of three minutes to five hours (page 7, lines 11-15).

G. Claim 7

Claim 7 depends from claim 1 and, therefore, contains all the limitations of claim 1.

Claim 7 further provides that the water-containing coal is brown coal containing 25 weight% to 85 weight% water, calculated on the basis of the water-containing coal (page 6, lines 1-9).

H. Claim 8

Claim 8 provides a method for preparing a slurry of coal and water. The method comprises: (1) providing in a sealed vessel a mixture comprising (i) water which was removed from the water-containing coal and (ii) the coal from which the water was removed according to the method of claim 1 (page 9, line 28 to page 10, line 22); and (2) adjusting the water content of the resulting mixture by removing water from the mixture or adding water to the mixture (page 10, lines 5-15) in order to have a final water content in the mixture of from 30 to 50% by weight, calculated on the basis of the resulting mixture (page 10, lines 6-8).

I. Claim 9

Claim 9 depends from claim 8 and, therefore, contains all the limitations of claim 8.

Claim 9 further recites that the water content in the mixture is 40 to 50% by weight, calculated on the basis of the resulting mixture (page 10, lines 6-8).

J. Claim 10

Claim 10 provides a method of isolating the coal from the removed water. The method comprises (1) providing a mixture including (i) water which is removed from water containing coal and (ii) coal from which water is removed in a sealed vessel according to the

method of claim 1 and (2) removing the water from the mixture to isolate the coal (page 10, line 5 to page 11, line 4).

K. Claim 11

Claim 11 depends from claim 10 and, therefore, contains all the limitations of claim 10. Claim 11 further provides that the water is removed from the mixture so that the coal contains not more than 15% by weight of water, based on the total amount of the coal and water (page 10, lines 25-27).

L. Claim 12

Claim 12 depends from claim 10 and, therefore, contains all the limitations of claim 10. Claim 12 further provides that the water is removed from the mixture so that the coal does not substantially contain water (page 10, lines 23-27).

M. Claim 13

Claim 13 provides a method for preparing bitumen-containing coal. The method comprises adding 1 to 25 weight% bitumen, calculated on the basis of dry coal, to the dewatered coal obtained by claim 10 (page 11, lines 5-10).

N. Claim 14

Claim 14 depends from claim 13 and, therefore, contains all the limitations of claim 13. Claim 14 further provides that the amount of bitumen is 5 to 20 weight%, based on the dry coal (page 11, lines 5-10).

O. Claim 15

Claim 15 depends from claim 13 and, therefore, contains all the limitations of claim 13. Claim 15 further provides that the bitumen is natural asphalt, petroleum asphalt or coal tar (page 11, lines 8-10).

P. Claim 16

Claim 16 depends from claim 1 and, therefore, contains all the limitations of claim 1.

Claim 16 further provides that the pore volume of the water-containing coal is reduced by at least 68% (Table 1 (pore volume), page 11 and Table 4 (pore volume), page 15).

Q. Claim 17

Claim 17 depends from claim 2 and, therefore, contains all the limitations of claim 2.

Claim 17 further provides that the stirring blade of claim 2 is comprised of blades that vary in pitch, the pitch being the greatest at a site nearest the supply port (page 8, lines 20-26).

VI. GROUNDΣ OF REJECTION TO BE REVIEWED ON APPEAL

The following grounds of rejection are presented for review:

- 1) Claims 1-7, 10-12 and 16 are rejected under 35 U.S.C. §103(a) over U.S. Patent No. 4,702,745 to Kamei ("Kamei") as evidenced by U.S. Patent No. 4,607,796 to Enikolopov et al. ("Enikolopov").
- 2) Claims 8 and 9 are rejected under 35 U.S.C. §103(a) over Kamei in view of U.S. Patent No. 4,216,082 to Verschuur ("Verschuur").
- 3) Claims 13-15 are rejected under 35 U.S.C. §103(a) over Kamei in view of U.S. Patent No. 2,824,790 to Gregory ("Gregory").
- 4) Claim 17 is rejected under 35 U.S.C. §103(a) over Kamei in view of U.S. Patent No. 4,477,257 to Koppelman ("Koppelman") and U.S. Patent No. 3,529,981 to Hawkins et al. ("Hawkins").

VII. ARGUMENT

The Examiner rejects claims 1-7, 10-12 and 16 under 35 U.S.C. §103(a) over U.S. Patent No. 4,702,745 to Kamei ("Kamei") as evidenced by U.S. Patent No. 4,607,796 to Enikolopov et al. ("Enikolopov"); claims 8 and 9 under 35 U.S.C. §103(a) over Kamei in view of U.S. Patent No. 4,216,082 to Verschuur ("Verschuur"); claims 13-15 under 35 U.S.C. §103(a) over Kamei in view of U.S. Patent No. 2,824,790 to Gregory ("Gregory"); and claim 17 under 35 U.S.C. §103(a) over Kamei in view of U.S. Patent No. 4,477,257 to Koppelman ("Koppelman") and U.S. Patent No. 3,529,981 to Hawkins et al. ("Hawkins").

A. Claim 1 Would Not Have Been Rendered Obvious Over The Applied References

Appellant respectfully submits that the applied references would not have rendered the presently claimed invention obvious to one of ordinary skill in the art because (1) the record fails to establish that a shearing force of 0.01 MPa to 20 MPa is inherently present in Kamei, (2) the record fails to establish that applying a shearing force during the dewatering of a water-containing coal is a result-effective variable, (3) one of ordinary skill in the art would not have modified Kamei, as evidenced by Enikolopov, in the manner asserted, and (4) there would have been no reason to modify the teachings of the applied references in order to arrive at the claimed method, without hindsight benefit of Applicant's claims and specification.

1. The record does not establish that a shearing force of 0.01 MPa to 20 MPa is inherently present in Kamei

Appellant respectfully submits that a shearing force of 0.01 MPa to 20 MPa is not inherently present in Kamei because (a) it is improper to rely on inherency when the record does not establish that Kamei **necessarily** applies the recited shearing force to a water-containing coal, (b) the record lacks any findings that the method of Kamei applies a shearing force of 0.01 MPa to 20 MPa to a water-containing coal, (c) Enikolopov's teaching with respect to the shear force exerted on rubber measuring up to 100 x 50 x 30 mm by a screw

extruder are not relevant to the claimed method of dewatering a water-containing coal, (d) there is no evidence of record, nor any technical reasoning provided by the Examiner, that establishes that every combination of operational parameters and materials selected for the screw extruder apparatus of Kamei necessarily results in the recited shearing force, and (e) not all screw extruders are capable of exerting a shearing force of 0.01 MPa to 20 MPa.

a. **It is improper to rely on inherency when the record does not establish that Kamei necessarily applies the recited shearing force to a water-containing coal**

To the extent the Examiner asserts that a shearing force of "0.01 MPa to 20 MPa," as required by claim 1 (as opposed to a shearing force that is either higher or lower than the claimed range) is disclosed in Kamei based on a theory of inherency, such assertions are not properly established and are thus improper. Specifically, it is improper for the Examiner to rely on inherency in this regard because (as discussed in detail below) the method of Kamei does not **necessarily** apply the recited shearing force to a water-containing coal, which is required to support an inherency rejection.

As is well settled:

To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. **Inherency, however, may not be established by probabilities or possibilities.** The mere fact that a certain thing may result from a given set of circumstances is not sufficient.'

In re Robertson, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999) (citations omitted). Furthermore, MPEP §2112(IV) states “[i]n relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art.’ *Ex parte Levy*, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990).”

As discussed in detail below, Appellant respectfully submits that the Examiner's reliance on inherency is improper.

- b. **The record lacks any findings that the method of Kamei applies a shearing force of 0.01 MPa to 20 MPa to a water-containing coal**
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The Examiner acknowledges that Kamei merely teaches that a screw extruder type compressing-depressurizing unit is used to exert a mechanical force. *See April 19, 2011 Final Rejection at page 3; see also* Kamei at col. 6 lines 7-12. The Examiner also acknowledges that Kamei fails to explicitly teach or suggest that *any* shearing force is applied, much less "a shearing force of 0.01 MPa to 20 MPa," to the water-containing coal, as required by claim 1. *See April 19, 2011 Final Rejection at page 3.* However, the Examiner asserts that (1) a screw extruder inherently would impart both a compression force and a shearing force because screw extruders function by rotating, and (2) as the screw extruder rotates it imparts a force that is parallel to the coal, deforming it. *See April 19, 2011 Final Rejection at page 8.*

Such assertions do not include any findings pertaining to the magnitude of the alleged shearing force provided or whether the alleged shearing force falls within the claimed range (as opposed to a shearing force that is either higher or lower than the currently claimed range). The Examiner's reliance on col. 6, lines 7-12 of Kamei for the teaching of a screw extruder type compressing-depressurizing unit being used to exert a mechanical force and that a screw extruder provides a compression force as well as a shearing force (*see April 19, 2011 Final Rejection at page 3*) clearly falls short of a showing that Kamei teaches or suggests a shearing force of 0.01 MPa to 20 MPa, much less that such a shearing force will always result from a screw extruder type of compressing-depressurizing unit.

Furthermore, Appellant submitted evidence (see item 1 of the attached Evidence Appendix) in the form of a Declaration on December 18, 2009 indicating that the usual screw extruders, as described in Kamei, are not capable of exerting a high shearing force of 0.01 to

20 MPa to water-containing coal. *See* Declaration filed December 18, 2009 at page 2, second paragraph.

The other applied references are only relied upon for their alleged teachings of the features of the dependent claims and thus do not cure the above deficiencies with respect to claim 1.

Thus, for at least the reasons presented above, the Examiner has failed to meet his initial burden of presenting a *prima facie* case of obviousness, and the rejections should be reversed.

- c. **Enikolopov's teaching with respect to the shear force exerted on rubber measuring up to 100 x 50 x 30 mm by a screw extruder is not relevant to show that each limitation of the claim is described or suggested by the prior art or would have been obvious based on the knowledge of those of ordinary skill in the art**
-

The Examiner's reliance on Enikolopov as evidence indicating that it is possible for the extruding apparatus and specific materials of Kamei to achieve the claimed features is misplaced. Enikolopov is unrelated to applying shear forces to water-containing materials, such as water containing coal. With respect to the method disclosed therein, Enikolopov states that:

The process is performed in a single-screw or multiple-screw extruder having at least two temperature zones, each capable of either heating or cooling depending on the procedure. Coarsely cut pieces of rubber measuring up to 100 x 50 x 30 mm are fed into said extruder.

See Enikolopov at col. 4, lines 4-9. Enikolopov then discloses making powder from these rubber chunks by a process comprising compressing the rubber and pulverizing the compressed rubber chunks by applying a pressure of 0.2 to 50 MPa, and a shear force of 0.03 to 5 N/mm² to the initial rubber material. *See* Enikolopov at col. 2, lines 31-40; and col. 3, lines 10-31. Based on the teachings of Enikolopov, the Examiner asserts that it would have been obvious to one of ordinary skill in the art "to use a screw, extruder type compressing-

decompressing may [sic] be [sic] used [sic] to generate a shear force of 9.807 MPa since KAMEI teaches in lines 44-46 of column 4 that FIG 3 is an embodiment of compressing-depressing units." See April 19, 2011 Final Rejection at pages 3 and 4.

However, 9.807 MPa is almost two times the magnitude of the shearing force disclosed in Enikolopov, and thus the Examiner's conclusion is mere speculation and not supported by any evidence of record.

Furthermore, there is no evidence of record, nor any technical reasoning provided by the Examiner, to establish that rubber chunks measuring up to 100 x 50 x 30 mm are equivalent to a water-containing coal such that teachings regarding shear forces for one would have applied to the other. For example, the specification indicates that the viscosity of a material being acted upon by a stirring blade of a screw extruder is directly related to the shearing force obtained. See specification at pages 8 and 9. However, the Examiner has provided no basis for concluding that the rubber chunks measuring up to 100 x 50 x 30 mm of Enikolopov would have had the same viscosity as a water-containing coal.

Thus, the Examiner has established no reasonable basis for concluding that similar shearing forces are possible when using the apparatus of the applied references or would be observed for such unrelated materials. Accordingly, Enikolopov's teachings with respect to the shear force initially exerted on rubber chunks measuring up to 100 x 50 x 30 mm are not relevant to the claimed method of dewatering water-containing coal at least because the Examiner has failed to show how applying a shearing force of 0.01 MPa to 20 MPa to a water-containing coal, as required by claim 1, would have been obvious based on such unrelated teachings provided in Enikolopov's disclosure.

Thus, the Examiner improperly relies on Enikolopov to support his conclusion of obviousness, and the rejection should be reversed.

d. **Not all screw extruders are capable of exerting a shear force as recited in claim 1**

Contrary to the Examiner's assertions (*see* April 19, 2011 Final Rejection at pages 3 and 4), Appellant respectfully submits that one of ordinary skill in the art would recognize that not every type of screw extruder can be used to generate a shear force of 0.03 to 5 MPa, or 9.807 MPa (as asserted by the Examiner), on water-containing coal. As discussed above, Appellant's Declaration submitted on December 18, 2009 provides evidence that the usual screw extruders, such as those described in Kamei, are not capable of exerting a high shearing force of 0.01 to 20 MPa on such materials. *See* Declaration filed December 18, 2009 at page 2, second paragraph.

Furthermore, there are a large variety of screw extruders available, and the shearing force experienced by a material depends on multiple factors including, but not limited to, the *specific* apparatus, the set of operating conditions, *and the material being acted upon*, not just the type of apparatus being used. *See* specification at pages 8 and 9. For example, there are many types of screw extruders that are available for extruding specific types of materials, such as rubbers, foods or metals. Screw extruders are even built as children's toys that extrude materials like play dough; however, because a toy screw extruder may compress the material it acts on to some extent provides no indication that it would be capable of exerting a 0.03 to 5 MPa shear force to every composition it acts on (e.g., from play dough to softened metals).

Clearly, the Examiner fails to appreciate that the shearing force experienced by a material depends on multiple factors including, but not limited to, the *specific* apparatus, the set of operating conditions of the apparatus, and *the material being acted upon* (e.g., the viscosity of the material), not just the general overall type of apparatus being used (e.g., a screw extruder type). *See* specification at pages 8 and 9.

Thus, for at least the reasons presented above, the Examiner supplies erroneous reasoning in support of his alleged *prima facie* case of obviousness, and thus the rejections should be reversed.

- e. **There is no evidence of record, nor any technical reasoning provided by the Examiner, that establishes that every combination of operational parameters and materials selected for the screw extruder apparatus of Kamei necessarily results in the recited shearing force**
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That the screw extruder identified in Kamei may happen to exert some shearing force if it is operated at the appropriate settings and with the appropriate materials does not mean that every combination of operational parameters and materials selected for this apparatus necessarily results in a shearing force of "0.01 MPa to 20 MPa" on water containing-coals, as required by claim 1.

Instead, one of ordinary skill in the art would infer from the disclosure of Kamei that significant shearing forces are not applied. For example, Kamei suggests that it is desirable to mechanically compress a material to dewater it, such that the screw functions to exert the extruding/pressing force on a material in order it to make it longitudinally travel through the compressing chamber. *See* Kamei at col. 1, lines 7-10 and col. 2, lines 44-68. However, there is no mention of applying a shearing force.

Instead, in the single screw extruder of Kamei, dewatered coal falls through a chute and into a compressing chamber, where it is then forced into a tapered mold by a forwarding screw. *See* Kamei at col. 6, lines 7-13 and Fig. 3. The forwarding screw compresses the coal in a forward axial direction toward the opening of the extruder chamber. *See* Kamei at col. 6, lines 13-27 and Fig. 3. As a result, back pressure generation is negligible in the single screw extruder of Kamei because all of the dewatered coal particles move forward, in the direction of the forwarding screw. With all the particles moving in the direction of the forwarding screw there is little opportunity or possibility for producing the magnitude of the claimed

shearing force. *See* Declaration filed December 18, 2009 at pages 1 and 2. Thus, as stated in the Declaration filed December 18, 2009, the usual screw extruders, as described in Kamei, are not capable of exerting a high shearing force of 0.01 to 20 MPa to water-containing coal.

Additionally, the application of only a mechanical compression for dewatering is common to all the systems disclosed in Kamei. For example, similar to the single screw extruder employed in Kamei, in the reference's stamping extruder type, the tip of the stamping plunger also exerts the extruding/pressing force to push the coal through a tapered mould. *See* Kamei at col. 6, lines 28-34. The mould is composed of multiple depressurizing chambers. *See* Kamei at col. 6, lines 35-38. As the brown coal travels toward the end of the mould, whose volume progressively decreases, moisture is squeezed by compression (e.g., the water is squeezed by compression of capillaries in the brown coal). *See* Kamei at col. 6, lines 37-41; and Fig. 4.

Thus, the systems in Kamei merely suggest mechanically compressing a material to dewater it, and the screw merely functions to exert the extruding/pressing force on a material, such as brown coal, in order it to make it longitudinally travel through the compressing chamber such that a lump formed solid is obtained.

Therefore, the evidence of record supports that the single screw extruder employed during the compressing-depressurizing step of Kamei at most generates an *insignificant* amount of shear force, which is insufficient to generate any noticeable or consequential effect and markedly less than a shearing force of "0.01 MPa to 20 MPa," as required by claim 1.

Thus, for at least the reasons presented above, there is no indication that the screw extruder of Kamei **necessarily** produces the recited shearing force. Accordingly, the Examiner has failed to establish that Kamei inherently discloses applying a shearing force of 0.01 MPa to 20 MPa to a water-containing coal, as opposed to a shearing force that is either higher or lower than the currently claimed range.

The other applied references are only relied upon for their alleged teachings of the features of the dependent claims and thus do not cure the above deficiencies with respect to claim 1. Therefore, claim 1 and its dependent claims would not have been rendered obvious by the applied references.

Thus, for at least the reasons presented above, the Examiner has failed to meet his initial burden of presenting a *prima facie* case of obviousness, and the rejections should be reversed.

2. There is no evidence of record suggesting that applying a shearing force during the dewatering of a water-containing coal is a result-effective variable

Whether or not Kamei generates an insignificant amount of shear force, Appellant respectfully submits that the record fails to establish that it was known in the art that the application of a shearing force during the dewatering of any material, much less during the dewatering of a water-containing coal, is a result effective variable. Thus, it would not have been obvious to adjust or optimize such a parameter.

It is well settled that in order for it to be obvious to adjust or optimize a parameter it must first be recognized as a result-effective variable. See MPEP 2144.05(II)(B). As stated in MPEP 2144.05(II)(B), "[a] particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation," citing *In re Antonie*, 559 F.2d 618, 195 USPQ 6 (CCPA 1977).

Kamei does not describe any result to be derived from the application of a shearing force on a material, much less application of a shearing force on a water-containing coal. In fact, none of the applied references recognize that applying a shearing force on a material to be dewatered achieves a recognized result. The Examiner does not assert otherwise.

The Examiner asserts that (1) a screw extruder inherently would impart both a compression force and a shearing force because screw extruders function by rotating, and (2) as the screw extruder rotates it imparts a force that is parallel to the coal, deforming it. *See April 19, 2011 Final Rejection at pages 3 and 8.* The Examiner acknowledges that Kamei fails to explicitly teach or suggest that *any* shearing force is applied, much less "a shearing force of 0.01 MPa to 20 MPa," to the water-containing coal, as required by claim 1. *See April 19, 2011 Final Rejection at page 3.* Thus, for at least these reasons, Kamei does not recognize that the application (and magnitude) of a shearing force is a result-effective variable for the dewatering of any material, much less a water-containing coal.

Neither Enikolopov nor the evidence of record provides any suggestion that Enikolopov's teachings are germane and/or applicable to dewatering water-containing coal. Instead, Enikolopov merely discloses making powder from rubber and rubber vulcanization products by a process comprising compressing the rubber and pulverizing the compressed rubber material by applying a pressure of 0.2 to 50 MPa, and a shear force of 0.03 to 5 N/mm². *See Enikolopov at col. 1, lines 8-9; col. 2, lines 31-40; and col. 3, lines 18-31.* However, because Enikolopov does not relate to dewatering materials, much less dewatering a water-containing coal, Enikolopov fails to recognize that the application (and magnitude) of a shearing force is a result-effective variable for the dewatering of any material, much less a water-containing coal.

Because the record does not establish and the applied references do not teach or suggest the application of a shearing force for dewatering of any material, much less a water-containing coal, as a result-effective variable, it would not have been obvious to one of ordinary skill in the art from these references to adjust (or optimize) the teachings of the applied references to arrive at the combination of features recited in claim 1. The other

applied references are only relied upon for their alleged teachings of the features of the dependent claims and thus do not cure the above deficiencies with respect to claim 1.

Therefore, for at least the above reasons, the Examiner fails to make a *prima facie* case for obviousness, and the rejections should be reversed.

3. One of ordinary skill in the art would not have modified Kamei in the manner asserted

The Examiner's proposed modification of Kamei in view of the evidence set forth in Enikolopov is improper because the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose. As discussed in detail below, the Examiner's proposed modification would result in the method of Kamei utilizing conditions that should result in a powder and thus would have rendered the method of Kamei unsatisfactory for its intended purpose of obtaining a strong lump-formed solid. Thus, one of ordinary skill in the art would not have modified Kamei in the manner asserted by the Examiner.

Kamei is directed to a process for efficiently dewatering a high moisture, porous organic solid in order to obtain a strong lump-formed solid. *See* Kamei at col. 1, lines 7-10 and col. 2, lines 44-68 (the latter of which is reproduced below for convenience (emphasis added)).

An object of the present invention is to solve the foregoing problems and to provide a process for dewatering a high moisture porous organic solid comprising steps of

(1) heating the high moisture porous organic solid in a fluid medium having an elevated temperature and a high pressure, thereby softening and shrinking the porous structure of the solid, thereby improving the quality of the solid, thereby lowering the viscosity of the moisture, thereby reducing the moisture of the solid,

(2) starting to compress the porous structure of the solid by mechanical means, while maintaining the temperature and the pressure of the surrounding fluid medium the same as in the final stage of the step (1), thereby consolidating the softened solid, expelling the low viscosity moisture from the capillaries of the solid, and then,

(3) lowering the pressure of the surrounding fluid medium, thereby

evaporating the residual moisture, while maintaining the mechanical compression of the solid, thereby collapsing the void capillaries left by the evaporated moisture, and *thus obtaining a strong lump-formed solid having an improved quality and high calorific values both per volume and weight.*

From the above disclosure, one of ordinary skill in the art would recognize that Kamei opposes forming powders.

The Examiner relies on Enikolopov in order to demonstrate that the screw extruder of Kamei would have been capable of exerting a shearing force of 0.03 to 5 MPa or 9.807 MPa. *See April 19, 2011 Final Rejection, pages 3, 4, 8 and 9.* The Examiner then asserts that one of ordinary skill in the art would expect similar results (as obtained in Enikolopov) to be obtained in the method of Kamei if a shearing force of 0.03 to 5 MPa (as evidenced by Enikolopov) is applied. *See April 19, 2011 Final Rejection at page 9,* which states "a similar apparatus (a screw extruder with similar conditions ([sic]compressing force of 0.03 to 5 N.[sic]mm² would result in similar results." As discussed below, such similar results would clearly involve the formation of a powder, in contrast to the method of Kamei (which seeks to obtain a strong lump-formed solid).

Specifically, Enikolopov is directed a *pulverization process* in which a single- or multiple-screw extruder applies a shearing force of 0.03 to 5 MPa to chunks of rubber *to make a powder.* *See Enikolopov at col. 2, lines 25-30, lines 33-35, lines 53 and 54 (all of which are reproduced below for convenience (emphasis added).*

It is an object of the present invention to provide a method for making a powder from rubber or vulcanization products, which is capable of producing a more finely dispersed powder and consume less power as contrasted to the prior art methods....

There is provided a method for making a powder from rubber and rubber vulcanization products *by applying a shearing force* to the initial material... the compressed material is pulverized by simultaneously applying a pressure ranging from 0.2 to 50 MPa and a shear force *ranging from 0.03 to 5 N/mm²...*

The pulverization process is a continuous process performed in a single- or multiple-screw extruder.

The Examiner's acknowledgement that one of ordinary skill in the art would expect similar results indicates that the Examiner concedes that a powder, which is not a strong lump-formed solid, would have been expected to result when a shearing force of 0.03 to 5 MPa (as evidenced by Enikolopov) is allegedly applied by a screw extruder in the method of Kamei.

Thus, the Examiner's proposed modification would result in the method of Kamei utilizing conditions that would have been expected to result in a powder, as occurred in Enikolopov. The Examiner does not assert otherwise. Such a modification renders Kamei unsatisfactory for its intended purpose of obtaining a strong lump-formed solid. Because the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

Thus, Kamei cannot be modified in the manner asserted by the Examiner because the proposed modification improperly renders the primary reference unsatisfactory for its intended purpose. Accordingly, the rejections are improper, at least because there is no reason (suggestion or motivation) to make the proposed modification and thus the Examiner has failed to establish a proper *prima facie* case of obviousness. For this reason alone, the rejections should be reversed.

4. There would have been no reason to modify the teachings of the applied references in order to arrive at the claimed method, without hindsight benefit of Applicant's claims and specification

Appellant respectfully submits that evidence found within the prior art by the Examiner fails to render obvious the claimed features because the Examiner only arrives at the claimed method by relying on Applicant's own claims and specification as a roadmap for modifying Kamei.

The claimed method functions differently than the methods of the applied references in that the claimed method is directed to *dewatering a water-containing coal* and requires the application of a shearing force of "0.01 MPa to 20 MPa" to a *water-containing coal*; this concept is not taught or suggested in the applied references.

As discussed above, the systems in Kamei merely suggest mechanically compressing a material to dewater it, and the screw merely functions to exert the extruding/pressing force on a material, such as brown coal, in order to make it longitudinally travel through the compressing chamber such that a lump formed solid is obtained. Additionally, for the reasons presented above, the record indicates that the single screw extruder employed during the compressing-depressurizing step of Kamei may only generate an *insignificant* amount of shear force, which is insufficient to generate any noticeable or consequential effect and definitely less than a shearing force of "0.01 MPa to 20 MPa," as required by claim 1. *See* Sections A(1)(c) and A(1)(d).

The record also includes a Declaration submitted on December 18, 2009, which indicates that the usual screw extruders, as described in Kamei, are not capable of exerting a high shearing force of 0.01 to 20 MPa on water-containing coal. Thus, the evidence supports that usual screw extruders, such as those of Kamei, would not achieve the recited shearing force when acting on water-containing coal.

Enikolopov is not relevant to dewatering materials, much less dewatering a water-containing coal, as claimed. Instead, Enikolopov discloses making powder from rubber and rubber vulcanization products by a process comprising compressing the rubber and *pulverizing* the compressed rubber chunks by applying a pressure of 0.2 to 50 MPa, and a shear force of 0.03 to 5 N/mm². *See* Enikolopov at col. 1, lines 8-9; col. 2, lines 31-40; and col. 3, lines 18-31.

Appellant does not dispute that Enikolopov discloses a screw extruder applying a 0.03 to 5 MPa shear force to rubber or rubber vulcanization products in order to pulverize the rubber or rubber vulcanization products. However, as discussed above (*see* Section A(2)), neither Enikolopov nor the evidence of record provides any reasons or suggestions as to how or why Enikolopov's teachings would be germane and/or applicable to dewatering water-containing coal. Thus, the evidence of record fails to teach or suggest the concept of applying a shearing force of 0.01 MPa to 20 MPa to a *water-containing coal* in order to dewater it.

Accordingly, there would have been no reason or rationale to have modified Kamei in view of the evidence set forth in Enikolopov in a manner necessary to have arrived at the claimed method, without hindsight benefit of Applicant's specification.

For at least these reasons, Appellant respectfully submits that the Examiner unreasonably modifies Kamei without the requisite articulated reasoning and rational underpinning to support a conclusion of obviousness. The other applied references are only relied upon for their alleged teachings of the features of the dependent claims and thus do not cure the above deficiencies with respect to claim 1.

Therefore, claim 1 and its dependent claims would not have been rendered obvious by the applied references. Accordingly, reversal of the rejections is respectfully requested.

B. Claims 8 and 9 Would Not Have Been Obvious Over Kamei In View Of Verschuur

Claims 8 and 9 are directed to a method of producing a slurry comprised of the dewatered coal of claim 1.

The Examiner acknowledges that Kamei does not teach or suggest methods of producing slurries of combustible solids wherein the water content in the slurry is adjusted to 30-50 % (claim 8) or 40-50% (claim 9). *See* April 19, 2011 Final Rejection at page 6. However, the Examiner asserts that one of ordinary skill in the art would have modified the

teachings of Kamei to create a slurry as described in Verschuur, and thus arrived at the claimed features. *See April 19, 2011 Final Rejection at page 6.*

Appellant respectfully disagrees because the Examiner's proposed modification would result in the method of Kamei forming a slurry and thus would have rendered the method of Kamei unsatisfactory for its intended purpose of obtaining a strong lump-formed solid.

Specifically, as discussed above (*see* section A(2)), Kamei is directed to a process for efficiently dewatering a high moisture, porous organic solid in order to obtain a strong lump-formed solid. *See* Kamei at col. 1, lines 7-10 and col. 2, lines 44-68. In contrast, the teachings of Verschuur relate to a method for processing a slurry of coal particles. *See* Verschuur, Abstract. Accordingly, because the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

Thus, Kamei cannot be modified in the manner asserted by the Examiner because the proposed modification improperly renders the primary reference unsatisfactory for its intended purpose. Accordingly, the rejection is improper, at least because there is no reason (suggestion or motivation) to make the proposed modification and thus the Examiner has failed to establish a proper *prima facie* case of obviousness. For this reason alone, the rejection should be reversed.

**C. Claim 10 Would Not Have Been Obvious Over
Kamei As Evidenced By Enikolopov**

For reasons discussed below, the Examiner errs in applying Kamei as evidenced by Enikolopov because the Examiner mistakenly equates the coal of Kamei with coal obtained according to claim 1.

Claim 10 is directed to a method comprising providing a mixture containing water which is removed from water-containing coal and coal from which the water is removed in a sealed vessel as obtained according to claim 1, and subsequently removing the water from the mixture to isolate the coal from which the water was removed.

The Examiner asserts that Kamei discloses an example in Table 2 in which coal having 3.9% wt moisture is obtained. *See* April 19, 2011 Final Rejection at page 6. However, such coal is structurally different from coal from which the water was removed in a sealed vessel as obtained according to claim 1 because it was dewatered by the method of Kamei, which at most generates an *insignificant* amount of shear force much lower than the range recited in claim 1 (*see* Section A(1)(e)).

For example, as discussed above (*see* Section A(1)(e)), the evidence of record shows that the single screw extruder employed during the compressing-depressurizing step of Kamei at most generates an *insignificant* amount of shear force, which is insufficient to generate any noticeable or consequential effect and is markedly less than a shearing force of "0.01 MPa to 20 MPa." Claim 10 requires that the coal is coal from which the water is removed in a sealed vessel as obtained according to claim 1. As demonstrated in the Declaration filed on December 18, 2009, coal that is not obtained in accordance with the method of claim 1 will reabsorb water that had been removed from the coal by such methods.

Thus, the structure of the coal in Kamei is different from that of the recited coal that is used in the method of claim 10 in that the recited coal has a pore structure that is substantially destroyed (*see* specification at page 1, lines 18-26; page 3, lines 16-22) and thus inhibited from reabsorbing water after dewatering. *See* specification at page 2, lines 18-20.

Thus, the applied references, alone or in combination, fail to teach or suggest, or establish any reason or rationale to provide, the features recited in claim 10. For at least these

reasons, claim 10 would not have been rendered obvious by Kamei as evidenced by Enikolopov. Accordingly, reversal of the rejection is respectfully requested.

D. Claims 13-15 Would Not Have Been Obvious Over Kamei In View Of Gregory

Claims 13-15 are directed to a method of preparing bitumen-containing coal comprised of the dewatered coal of claim 10. As discussed above in Section C, the Examiner erroneously applies Kamei as evidenced by Enikolopov because the Examiner mistakenly equates the coal of Kamei with the dewatered coal obtained according to claim 10.

As discussed above (*see* Section C), the coal of Kamei is structurally different from coal from which the water was removed in a sealed vessel as obtained according to claim 1, at least because it was dewatered by the method of Kamei, which at most generates an *insignificant* amount of shear force much lower than the range recited in claim 1.

Thus, the structure of the coal in Kamei is different from that of the recited dewatered coal that is required in the method of claims 13-15 in that the recited dewatered coal has a pore structure that is substantially destroyed (*see* specification at page 1, lines 18-26; page 3, lines 16-22) and thus inhibited from reabsorbing water after dewatering. *See* specification at page 2, lines 18-20.

Gregory is only relied upon for its alleged teachings with respect to bitumen and thus does not cure the above deficiencies with respect to claim 13 and its dependent claims.

Thus, the applied references, alone or in combination, fail to teach or suggest, or establish any reason or rationale to provide, the features recited in claims 13-15. For at least these reasons, claims 13-15 would not have been rendered obvious by Kamei and Gregory. Accordingly, reversal of the rejection is respectfully requested.

E. Claim 17 Would Not Have Been Obvious Over Kamei In View of Koppelman and Hawkins

The Examiner has failed to establish that an ordinarily skilled artisan would have combined the teachings of Hawkins and the other applied references in order to have modified Kamei's method to use a stirring blade as taught by Hawkins. For example, because Hawkins relates to adding water to dry components and mixing these components to obtain a uniform mixture, the teachings of this reference are irrelevant to a method of dewatering a water-containing coal including using a stirring blade comprised of a plurality of blades of varying pitch, the pitch being greatest at a site nearest to a supply port provided in a sealed vessel, as required by claim 17. Accordingly, the Examiner's assertion that Hawkins and the other applied references are combinable is erroneous.

Furthermore, claim 17 ultimately depends from claim 1, and thus includes all the features of claim 1. For at least the reasons presented above, Kamei fails to teach or suggest all of the features of independent claim 1 and, thus, would not have rendered obvious claim 1. Even if the applied references are combined, Koppelman and Hawkins fail to cure the deficiencies of Kamei with respect to claim 1.

None of the applied references discloses or suggests the concept of (1) applying a shearing force of 0.01 MPa to 20 MPa to a water-containing coal in order to dewater it, or (2) doing so with a stirring blade comprised of a plurality of blades of varying pitch, the pitch being greatest at a site nearest to a supply port provided, much less (3) applying a shearing force of 0.01 MPa to 20 MPa to a water-containing coal with a stirring blade comprised of a plurality of blades of varying pitch, the pitch being greatest at a site nearest to a supply port provided in a sealed vessel.

Koppelman is directed to method for the continuous processing of organic carbonaceous materials (*See Koppelman, Abstract*) that employs a screw conveyor 82a having

a progressively decreasing lead or pitch on moving toward the outlet end thereof in further combination with a perforated plate 154 interposed between the dewatering chamber 80a and the inlet of the reaction chamber 62a. *See Koppelman at col. 12, lines 34-44 and Figure 7.*

The Examiner has not presented any evidence and/or technical reasoning establishing that any shearing force applied in Koppelman would be in the range of 0.01 MPa to 20 MPa. Furthermore, because a perforated plate 154 is interposed between the dewatering chamber 80a and the inlet of the reaction chamber 62a, any alleged shearing force applied by the stirring blade of Koppelman does not occur in a sealed vessel. Thus, Koppelman does not cure the deficiencies of Kamei with respect to claim 17.

Hawkins is directed to extruding asbestos-cement for the production of asbestos-cement shapes, and provides a technique for dry mixing of the asbestos and cement with the subsequent addition of water for use in the production of elongated shapes. *See Hawkins, Abstract.* In Hawkins, dry asbestos-cement materials are mixed with water in a selected manner in order to obtain extruded pieces of good quality and uniformity. *See Hawkins at col. 7, lines 62-68.* There is no suggestion of mixing water with the dry asbestos-cement materials in a process of dewatering the mixed material.

Because Hawkins relates to adding water to dry components and mixing these components to obtain a uniform mixture; there is no indication that the stirring blade disclosed in Hawkins would be useful to dewater any material, much less dewater a water-containing coal. Additionally, the Examiner has not presented any evidence and/or technical reasoning establishing that any shearing force allegedly applied in Hawkins would be in the range of 0.01 MPa to 20 MPa.

Accordingly, both Koppelman and Hawkins, considered either alone or in combination, fail to cure the deficiencies of Kamei at least because the references fail to provide one or ordinary skill in the art with any reason or rationale to modify the teachings of

Kamei in order to apply a shearing force of 0.01 MPa to 20 MPa to a water-containing coal, or do so with a stirring blade comprised of a plurality of blades of varying pitch, the pitch being greatest at a site nearest to a supply port provided, much less apply a shearing force of 0.01 MPa to 20 MPa to a water-containing coal with a stirring blade comprised of a plurality of blades of varying pitch, the pitch being greatest at a site nearest to a supply port provided in a sealed vessel. Therefore, there would have been no reason or rationale to have combined Kamei with Koppelman and Hawkins in a manner necessary to have arrived at the claimed method, without hindsight benefit of Appellant's specification and claims.

Furthermore, patentability of claim 17 is supported by unexpected results. With reference to Example 1 of the specification and the Declaration filed on December 18, 2009, water-containing coal was placed in a vessel at a pressure of 0.7 MPa and heated to a 170°C, at which point the pressure was immediately adjusted to 1 MPa and a shearing force of 0.1 MPa was applied, in accordance with the method recited in claim 1 (*see* specification at paragraphs [0029], [0032] and [0041]). The pore volume (percentage of void) of the coal decreased 68% in the method of claim 1 (*Id.*).

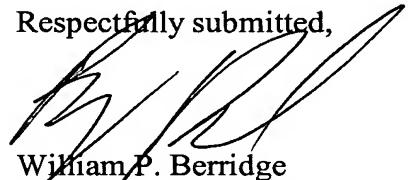
The above properties with respect to pore volume decrease by the application of shear force are nowhere disclosed in Kamei. Such benefits are not taught or even attainable by the applied references. Thus, as seen in the December 18, 2009 Declaration the subject matter of claim 17 achieves unexpected results.

Thus, for at least the reasons presented above, the applied references, alone or in combination, fail to teach or suggest, or establish any reason or rationale to provide, the features recited in claim 17. For at least these reasons, claim 17 would not have been rendered obvious by Kamei, Koppelman and Hawkins. Accordingly, reversal of the rejection is respectfully requested.

VIII. CONCLUSION

For all of the reasons discussed above, it is respectfully submitted that the rejections are in error and that claims 1-17 are in condition for allowance. For all of the above reasons, Appellants respectfully request this Honorable Board to reverse the rejections of claims 1-17.

Respectfully submitted,



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**APPENDIX A - CLAIMS APPENDIX****CLAIMS INVOLVED IN THE APPEAL:**

1. A method for dewatering and reducing pore volume of water-containing coal, comprising heating the water-containing coal at a temperature of 100°C to 350°C under a pressure not less than a saturated steam pressure at the temperature for the heating, while simultaneously applying a shearing force of 0.01 MPa to 20 MPa to the water-containing coal, in a sealed vessel.

2. The method according to Claim 1, wherein the shearing force is applied by a stirring blade provided in the sealed vessel.

3. The method according to Claim 1, wherein the temperature for the heating is 150°C to 300°C.

4. The method according to Claim 1, wherein the pressure during the heating is not more than the saturated steam pressure at the temperature for the heating + 0.5 MPa, provided that the pressure does not exceed 17.8 MPa.

5. The method according to Claim 1, wherein the shearing force is 0.1 MPa to 10 MPa.

6. The method according to Claim 1, wherein the heating is conducted in a period of from three minutes to five hours.

7. The method according to Claim 1, wherein the water-containing coal is brown coal containing 25 weight% to 85 weight% of water, calculated on the basis of the water-containing coal.

8. A method for preparing slurry, comprising providing in a sealed vessel a mixture obtained according to Claim 1, containing water which has been removed from water-containing coal and coal from which the water has been removed, and subsequently

removing the water from the mixture existing in the sealed vessel or adding water to the mixture, to adjust a water content in a final mixture to 30 weight% to 50 weight%, calculated on the basis of the mixture.

9. The method according to Claim 8, wherein the water content in the final mixture is 40 weight% to 50 weight%.

10. A method comprising providing a mixture containing water which is removed from water-containing coal and coal from which the water is removed in a sealed vessel as obtained according to Claim 1, subsequently removing the water from the mixture to isolate the coal from which the water was removed.

11. The method according to Claim 10, wherein water is removed from the mixture so that the coal contains not more than 15 weight% of water, based a total amount of the coal and water.

12. The method according to Claim 10, wherein water is removed from the mixture so that the coal substantially does not contain water.

13. A method for preparing bitumen-containing coal, comprising adding 1 weight% to 25 weight% of bitumen, calculated on the basis of dry coal, to the dewatered coal obtained in the method according to Claim 10.

14. The method according to Claim 13, wherein an amount of the bitumen is 5 weight% to 20 weight%, based on the dry coal.

15. The method according to Claim 13, wherein the bitumen is natural asphalt, petroleum asphalt or coal tar.

16. The method of claim 1, wherein the pore volume of the water-containing coal is reduced by at least 68%.

17. The method according to claim 2, wherein the stirring blade is comprised of a plurality of blades of varying pitch, the pitch being greatest at a site nearest to a supply port.



APPENDIX B - EVIDENCE APPENDIX

A copy of each of the following items of evidence is attached:

1. An affidavit filed under 37 CFR §1.132 on December 18, 2009 by Yukuo Katayama;
and
2. Definition of "shear" and "Pressure", McGraw Hill Encyclopedia of Science and
Technology, 9th ed. (2002)

The evidence has been entered into the record.



DECLARATION

I, the undersigned, Yukuo KATAYAMA, residing at 21-25, Daikyo-cho, Shinjuku-ku, Tokyo, Japan, hereby declare and state that:

I graduated from Hokkaido University in 1969 and received a doctorate on engineering from Hokkaido University in 1978; and has been the chairman of K.E.M. Co., Ltd from July 2005.

I am the inventor of the invention of US Patent Application Serial No. 10/564,988, entitled **METHOD FOR DEWATERING WATER-CONTAINING COAL**:

The following is the details of the experiments through which I reached the present invention::

1) First, I used a conventional screw-type of extruder which had a single screw and was 4 inches in inner diameter of a cylinder (vessel) and 20 inches in length. Brown coal was fed while the exit was closed in order to give a longer residence time and, thereby, higher accumulated force exerted on the brown coal. When the brown coal of the amount corresponded to approximately 15 % of the capacity (inner volume) of the extruder was fed, a current which was input to a motor started to increase. When the brown coal of the amount corresponded to approximately 60 % of the capacity was fed, the load on the motor exceeded the rated power, so that a safety device (auto-thermal) was activated to stop the rotation of the extruder. The brown coal was a little wet and tightly compacted between the gaps of the screw blades closer to the exit.

The extruder used had an only small opening between the screw and the wall of the cylinder (vessel). Accordingly, almost no material could go back toward the inlet. Then, I changed the opening between the screw and the wall of the cylinder to 2 mm (0.08 inch) and repeated the same experiments as mentioned above. However, it was found that de-watering proceeded scarcely. This is probably because the return flow of the brown coal in the direction of from the outlet to the inlet collides against the forward flow of the brown coal in the direction of from the inlet to the outlet, so the return flow would stop.

2) Learning from these failures, I adopted another instrument which was twin-shaft screw type kneader with in-vessel effective volume of 8 liters, in-vessel length of 600mm, longer vessel diameter of 160 mm, shorter vessel diameter of 100 mm, one screw was to send a material forward and the another screw was to send a material backward. The

exit was closed and brown coal was fed as described in the present Comparative Example 1. After an hour operation, the material was taken out, which was a highly viscous slurry. This means that dewatering occurred. After the slurry was left in a closed vessel for several days, most of water, which had once removed from the brown coal, returned into the brown coal so that the material was not in a slurry state any more.

3) Then, I reorganized the instrument. That is, the pitches between the total 13 stirring blades of each screw were changed as described in paragraph 0023 of the specification. The pitch between the blades at the nearest spot to the coal supply port (inlet) was 70 mm; the pitches decrease by 4 mm toward the downstream side in sequence; and the pitch at the nearest spot to the product-withdrawing port (outlet) was 22 mm. The results are as described in Example 1. It should be noted that in Fig. 2, the apparatus looks like having only one screw, but Fig. 2 is to show the positional relation of the parts, and actual design of the apparatus is as described in paragraph 0023.

4) I am of the opinions that as seen from 1) and 3) above, usual extruders as described in Kamei cannot cause the high shearing force of 0.01 to 20 MPa.

I further declare under the penalty of perjury of the laws of the United States that the foregoing is true and correct to the best of my information and belief.

14 December 2009
day month year

Yukuo Katayama
Yukuo KATAYAMA

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ENCyclopedia ARTICLE

Shear

Sections:

A straining action wherein applied forces produce a sliding or skewing type of deformation. A shearing force acts parallel to a plane as distinguished from tensile or compressive forces, which act normal to a plane. Examples of force systems producing shearing action are forces transmitted from one plate to another by a rivet that tend to shear the rivet, forces in a beam that tend to displace adjacent segments by transverse shear, and forces acting on the cross section of a bar that tend to twist it by torsional shear (Fig. 1). Shear forces are usually accompanied by normal forces produced by tension, thrust, or bending.

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APPENDIX C - RELATED PROCEEDINGS APPENDIX

Pending Appeal of Related Application No. 11/662,969 in which a Notice of Appeal

was filed on July 13, 2011 (Appeal Number Unavailable).